CLAIMS

What is claimed is:

1. A method of measuring a region on a sample, said region containing at least two different materials, said method comprising:

generating a phase profile of said region on said sample using at least one wavelength of light;

obtaining the material specific phase difference for said two different materials in said region;

correcting at least a portion of the phase profile with said material specific phase difference to generate an actual phase profile; and

converting at least a portion of said actual phase profile to an actual height profile.

2. The method of Claim 1, wherein said at least a portion of said actual phase profile is a lowest portion of one of said materials.

3. The method of Claim 1, wherein said actual height profile is used to determine dishing of one of said materials.

4. The method of Claim 1, wherein generating said phase profile comprises measuring the phase profile using a differential interferometer in referential mode.

5. The method of Claim 1, wherein generating said phase profile comprises measuring the phase profile using a differential interferometer in differential mode to produce a differential phase profile and integrating said differential phase profile to produce said phase profile.

6. The method of Claim 1, wherein obtaining the material specific phase difference for said two different materials in said region comprises:

obtaining the material specific phase value of a first material in said region;

obtaining the material specific phase value of a second material in said region; and

calculating the difference between said material specific phase value of said first material and said material specific phase value of said second material to obtain said material specific phase difference.

7. The method of Claim 6, wherein at least one of said obtaining the material specific phase value of said first material and said obtaining the material specific phase value of said second material comprises measuring the material specific phase value.

8. The method of Claim 6, wherein at least one of said obtaining the material specific phase value of said first material and said obtaining the material specific phase value of said second material comprises obtaining said material specific phase value from a reference source.

9. The method of Claim 6, wherein said generating a phase profile of said region on said sample using at least one wavelength of light uses a reference spot of light and a measurement spot of light and correcting at least a portion of the phase profile with said material specific phase difference to generate an actual phase profile is performed when said reference spot of light and said measurement spot of light are incident on different materials, said method further comprising:

measuring the phase and thickness of the first material, wherein said first material is at least partially transparent to said at least one wavelength of light;

generating the relationship between the phase and thickness of said first material for a desired thickness range; and

converting a second portion of said phase profile to said actual height profile using said material specific phase of said first material and said relationship between phase and thickness of said first material when said reference spot of light and said measurement spot of light are both incident on said first material.

10. The method of Claim 9, wherein generating the relationship between the phase and thickness of said first material comprises adding the contributions of said light reflected and transmitted at said first material using Fresnel equations.

11. The method of Claim 9, further comprising:

measuring the phase and thickness of said second material;

generating the relationship between the phase and thickness of the second material for a desired thickness range, wherein said second material is at least partially transparent to said at least one wavelength of light; and

wherein converting at least a portion of said actual phase profile to an actual height profile uses said material specific phase of said second material and said relationship between phase and thickness of said second material when said measurement spot of light is incident on said second material.

12. The method of Claim 1, wherein said generating a phase profile of said region on said sample using at least one wavelength of light uses a reference spot of light and a measurement spot of light, at least said measurement spot of light scanning across said region to generate said phase profile of said region, said method further comprising:

measuring the intensity of at least said measurement spot of light scanning across said region; and

determining the material at least said measurement spot of light is incident upon by the measured intensity.

13. A method of measuring a region on a sample, said region containing at least a first material, said method comprising:

generating a phase profile of said region on said sample using at least one wavelength of light, wherein said first material is at least partially transparent to said at least one wavelength of light;

obtaining the material specific phase and thickness of said first material at a reference location;

generating the relationship between the phase and thickness of said first material for a desired thickness range; and

converting at least a portion of the phase profile to a height profile using at least said material specific phase and thickness of said first material at said reference location and said relationship between phase and thickness of said first material.

14. The method of Claim 13, wherein said obtaining the material specific phase and thickness of said first material at a reference location comprises measuring the material specific phase with a reflectometer or an ellipsometer.

15. The method of Claim 13, wherein generating the relationship between the phase and thickness of said first material for a desired thickness range comprises adding the contributions of light reflected and transmitted at said first material using Fresnel equations.

16. The method of Claim 13, wherein said region also comprises a second material that is opaque to said at least one wavelength of light and wherein the material specific phase values of said first material and said second material is different, said method further comprising:

obtaining the material specific phase difference for said second material and said first material at said reference location; and

correcting at least a portion of said phase profile with said material specific phase difference;

converting at least a portion of the corrected phase profile to a height profile.

17. The method of Claim 16, wherein said obtaining the material specific phase difference comprises obtaining the material specific phase of said second material and calculating the difference between said material specific phase of said second material and said material specific phase of said first material at said reference location.

18. The method of Claim 13, wherein said region also comprises a second material, said method further comprising:

obtaining the material specific phase and thickness of said second material at a second location;

generating the relationship between the phase and thickness of said second material for a desired thickness range; and

converting a second portion of the phase profile to a height profile using at least said material specific phase and thickness of said second material at said second location and said relationship between phase and thickness of said second material.

19. The method of Claim 18, wherein said second material is different than said first material and is transparent to said at least one wavelength of light.

20. The method of Claim 18, wherein said second material is a composite of a transparent material and an opaque material, and wherein generating the relationship between the phase and

thickness of said second material comprises adding the contributions of said light reflected and transmitted at said second material using Fresnel equations.

21. The method of Claim 13, wherein said first material is a composite of a transparent material and an opaque material.

22. The method of Claim 13, wherein generating said phase profile of said region comprises measuring the phase profile using a differential interferometer in differential mode to produce a differential phase profile and integrating said differential phase profile to produce said phase profile.

23. The method of Claim 18, wherein said generating a phase profile of said region on said sample using at least one wavelength of light uses a reference spot of light and a measurement spot of light, at least said measurement spot of light scanning across said region to generate said phase profile of said region, said method further comprising:

measuring the intensity of at least said measurement spot of light scanning across said region; and

determining the material at least said measurement spot of light is incident upon by the measured intensity.

24. A method of determining the material intercepted by a spot of light during the measurement of a region including at least a first material and a second material, said method comprising:

measuring the intensity of at least said measurement spot of light scanning across said region; and

determining the material that at least said measurement spot of light is incident upon by the measured intensity.

25. The method of Claim 24, further comprising:

modulating the phase of radiation produced by a laser;

splitting said radiation produced by said laser into two beams;

reflecting said two beams of said sample;

recombining said two beams into a single beam; and

detecting said single beam.

26. The method of Claim 25, wherein detecting said single beam produces a detector signal, said method further comprising:

analyzing the intensity of said detector signal using

$$\text{Intensity} = A + B \times \text{Cos}(CV + D)$$

where A is the average intensity of the detector signal, B is one half of the peak to peak intensity, C is the modulator sensitivity, V is the applied modulator voltage and D is the phase shift associated with the two beams.

27. The method of Claim 26, further comprising:

determining a first intensity of one of said two beams and a second intensity of the other of said two beams using A and B and using the following formulas:

$$\text{First Intensity} = \frac{A + \sqrt{A^2 - B^2}}{2}$$

$$\text{Second Intensity} = \frac{A - \sqrt{A^2 - B^2}}{2}; \text{ and}$$

determining the material that said two beams are incident upon using at least one of said first intensity and said second intensity.